AUSTRALIA

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PATENT REQUEST : STANDARD PATENT

We, The Technology Group Pty Limited being the person identified below as the Applicant request the grant of a patent to the person identified below as the Nominated Persons for an invention described in the accompanying standard complete specification

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Nominated Person:	As Above
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Invention Title:	Conduit Means with Transmission Medium for Controlling a Plurality of Stations
Names of actual Inventor	Denham Cooper-Southam David Granville Llewelyn

ASSOCIATED PROVISIONAL APPLICATION DETAILS

Application Number:	PP0134
Date:	27 October 1998

Address for service in Australia: *CARTER SMITH & BEADLE*, 2 Railway Parade, Camberwell, Victoria, 3124, Australia (Attorney Code CD)

Dated 27 October 1998

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Patent Attorneys for the Applicant

TO: *The Commissioner of Patents*

Fee: **$280.00**

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(54) Title
CONDUIT MEANS WITH TRANSMISSION MEDIUM FOR CONTROLLING A PLURALITY OF STATIONS

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(57) Claim

1 Conduit means for transporting a fluid, such as gas or liquid, to be dispensed at one or more stations connected by said conduit means,

said conduit means having a transmission medium formed integrally with or bonded to the conduit means wherein said transmission medium is configured for transmission of information between any one or more of the stations and controller means so as to control any one or more of the stations or to transmit to or receive data from any one or more of the stations

11. An irrigation system comprising:

a plurality of stations distributed at various locations,

conduit means connecting each one of said plurality of stations for transporting fluid, such as water, to be dispensed at one or more of said stations;

a transmission medium formed integrally with or bonded to said conduit means;

said transmission medium being configured to transmit information between one or more of said plurality of stations and a controller means such that any one or more of said stations performs one or more functions in accordance with information transmitted by said controller means.

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COMPLETE SPECIFICATION

FOR A STANDARD PATENT

ORIGINAL

Name of Applicant:	The Technology Group Pty Limited
Actual Inventors:	Denham Cooper-Southam; David Granville Lawson
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Invention Title:	CONDUIT MEANS WITH TRANSMISSION MEDIUM FOR CONTROLLING A PLURALITY OF STATIONS

Details of Associated Provisional Application

PP0034 filed 2nd OCTOBER 1997

The following statement is a full description of this invention, including the best method of performing it known to us

CONDUIT MEANS WITH TRANSMISSION MEDIUM FOR CONTROLLING A PLURALITY OF STATIONS

This invention relates to a system for controlling a plurality of stations, and more particularly relates to a system for remotely controlling a plurality of stations interconnected by conduit means conveying a fluid, via means for transmitting signals that is incorporated with the conduit means.

Where a plurality of stations are required to be controlled by switching between two states, for example, in an irrigation system where each station has a valve for closing and opening a water supply, it has been necessary to install a pair of wires, to carry the electrical signals, leading to and from each station in the system so as to electrically control each station valve. In a system having many such stations, it means that separate wiring is required to be installed for each station. For stations that are separated by distance over an area, for example in crop irrigation, parks or gardens and are located a distance from the source of electrical power, it is clearly impractical, prohibitively expensive and labour intensive to have to separately install separate wiring to control each station.

The present invention seeks to overcome the above disadvantages by providing a system for controlling a plurality of stations requiring minimum installation and is less expensive to install and maintain.

The present invention provides the means to transmit and/or receive information, which may also be linked to a computer means or processor means to provide complete control over the system.

According to a first aspect of the invention, there is provided

conduit means for transporting a fluid, such as gas or liquid, to be dispensed at one or more stations connected by said conduit means;

said conduit means having a transmission medium formed integrally with, or bonded to said conduit means, wherein said transmission medium is configured for transmission of information between any one or more of said stations and controller means so as to control any one or more of the stations or to transmit to or receive data from any one or more of the stations..

According to a second aspect of the invention there is provided a system for transmitting information between one or more stations and a controller means, said system comprising

said one or more stations,

conduit means, connecting said one or more stations wherein fluid, such as a gas or liquid, is transported in said conduit means to be dispensed at said one or more of the stations ,

a transmission medium for transmitting said information,

wherein said transmission medium is either formed integrally with or bonded to said conduit means, and said information is transmitted between said one or more stations and the controller means to control any one or more of the stations or receive data from any one or more of the stations

The transmission medium may be formed integrally with and external to said conduit means wherein the transmission medium is co-extruded with said conduit means The transmission medium may alternatively be bonded to said conduit means

The transmission medium may be in the form of a pair of cables, or a pair of wires such that electrical signals transmit said information over said pair of wires or cables between each station and said controller means The wires are preferably made from copper, aluminium or an alloy or any other suitable conductor of electrical signals. Each station may have a pair of terminals for connection to a respective one of said pair of wires Adjacent each station the transmission medium may be detachable from said conduit means for connection to said terminals of each station

The transmission medium may be in the form of a single optical fibre cable configured for duplex transmission such that optical signals transmit said information over said optical fibre cable between each station and said controller means The transmission medium may be a pair of optical fibre cables, one optical fibre cable configured to transmit information from said controller means to one or more stations and the other optical fibre cable configured to transmit information from any one or more stations to the controller means. At each station and at the controller means there may be conversion means for converting electrical signals into optical signals and for converting optical signals into electrical signals.

The conduit means is preferably in the form of a pipe or tube for conveying the fluid to be distributed to one or more stations. The pipe or tube may be made from any suitable plastics material.

According to a third aspect of the invention there is provided an irrigation system comprising:

a plurality of stations distributed at various locations;

conduit means connecting each one of said plurality of stations for transporting fluid, such as water, to be dispensed at one or more of the stations;

a transmission medium integrally formed with or bonded to said conduit means;

said transmission medium being configured for transmission of information between one or more of said plurality of stations, and a controller means such that any one or more of said stations performs one or more functions in accordance with information transmitted by said controller means.

According to a fourth aspect of the invention there is provided a system for controlling a plurality of stations, said system comprising:

said plurality of stations;

conduit means connecting each one of said plurality of stations for transporting fluid to be dispensed at one or more of said stations;

a transmission medium integrally formed with or bonded to said conduit means;

wherein said transmission medium is configured for transmission of information between one or more of said plurality of stations and a controller means such that any one or more of the stations performs one or more functions in accordance with information transmitted by said controller means.

Any one or more of the stations may include a valve, controlled by the actuation of a solenoid, for distributing said fluid. Any one or more of the stations may include a moisture meter, a pump switch, lighting devices or any other electrical device wherein information about said station may be conveyed to said controller means and said one or more functions may include enabling and disabling any one of said valve, moisture meter, pump switch or lighting device, or any combination

thereof, at said station

A preferred embodiment of the invention will now be described with reference to the accompanying drawings wherein

Figures 1(a) to 1(c) are cross-sectional views of a conduit means with various configurations of co-extruded transmission mediums arranged in pairs on the conduit means in accordance with a first embodiment of the invention.

Figures 2(a) to 2(c) are cross-sectional views similar to Figures 1(a) to 1(c) showing "spare" pairs of transmission media

Figure 3 is a plan view of the conduit means and transmission medium adapted for connection between adjacent stations.

Figure 4 is a schematic view of a system according to a second embodiment of the invention showing the interconnection of a plurality of stations, using a pair of wires as a transmission medium

Figure 5 is a schematic view of a system according to a third embodiment of the invention showing the interconnection of a plurality of stations using optical fibre cable as a transmission medium

Shown in Figure 1(a), there is a conduit means 2 in the form of a pipe or tube through which is conveyed a fluid such as a gas or liquid. Integrally formed with the conduit means 2 is a transmission medium, being in the form of a pair of wires 4, 6 which are able to bidirectionally transmit and receive information and provide power. The pair of wires 4, 6 preferably are standard electrical wires and together with their casing 8 are coextruded with the pipe or tube 2 through known coextrusion techniques or alternatively are bonded to the pipe by, for example, heat bonding. The pipe or tube is preferably made of a suitable plastics material as is the casing 8 for each of the wires 4 and 6. As shown in each of Figures 1(a), (b) and (c) the wires 4, 6 are formed integrally with the pipe or tube 2 on the outer periphery of the pipe or tube 2. The pair of wires may be oriented in any particular arrangement around the outer surface of the pipe or tube and as is shown in Figure 1(c), the pair of wires may be co-located within the same extruded casing 8. The pair of wires are separated from each other through the conventional insulation plastic casing surrounding the wire core which may be made of copper, aluminium, an alloy or any other suitable conductor of electrical

signals. The pair of wires may alternatively be attached to or co-exist with the length of tube or pipe 2 by any suitable means

Shown in Figure 2(a), 2(b) and 2(c) are wires 4,6 of corresponding Figures 1(a), 1(b) and 1(c) but having an extra or spare pair of wires 5,7 for use when the wires 4,6 are unable to be used for transmitting signals or power due to a disconnection or breakage, for example. The spare pair of wires 5,7 may be arranged together in the casing 8 adjacent the wires 4,6 or anywhere on the periphery or outer surface of pipe 2. They may be co-located within the same extruded casing as shown in Figure 2(c)

In Figure 3, there is shown a plan view of the section of the pipe or tube 2 together with the pair of wires 4 and 6 which reside in an outer casing 8 integrally formed on that periphery or outer surface of the pipe or tube. The wires 4 and 6 are coextruded with a pipe or tube in such a fashion that the casing 8 of the wires may be peeled back or away from the outer surface of the pipe or tube 2. This is necessary where the pair of wires 4, 6 need to be connected to terminals of a station as is shown in Figure 3 at either end of the pipe or tube. The ends of the tube have been cut deliberately so that they can be connected in a standard fashion to each other, using standard fittings, or to each of the stations and the outer casings 8 of the wires that have been stripped away from the outer surface of the pipe 2 and the ends of the casing 8 have been stripped away to expose the bear wire or core 4 and 6 for ready connection to the station terminals

Alternatively, a clip may be used that attaches to the conduit means 2 and has prongs adapted to pierce the wire casing and make contact with the wires 4, 6. The clip may also have direct connections to terminals of a station, through respective wires, so that signals transmitted through the wires 4, 6 reach the station.

In Figure 4, there is shown a system 14 of a plurality of stations 10 interconnected by the conduit means 2 and linked to a controller means 12. One segment of tube 2 links adjacent stations 10 although in some situations a T-junction may need to be formed to connect a station 11 for example as shown in Figure 4. The wire pairs 4 and 6 are connected to respective terminals at each station so as to provide a connection for electrical signals that are transmitted between each station 10

or 11 and the controller means12 along the tubes 2

The controller means 12 is shown remotely located from the system 14 and may be linked to the system 14 by a wireless telecommunications link 36. Transceivers 13 and 15 may be used to transmit and receive the information transmitted between the controller means 12 and any one or more of the stations 10, 11. The controller means may be powered by a solar panel 38, or other power source such as a battery, and may communicate with office terminal equipment 32 over a wireless telecommunications link 34 through transceivers 13 and 30. As an alternative to using wireless telecommunication links 34 and 36, wire pairs 4,6 or optical fibre cables may be used to transmit the information. The office terminal equipment 32 typically is in the form of a processor means, such as a computer system, and may be used to monitor and analyse the information transmitted to and received from the stations 10, 11 or any devices associated with the stations.

The controller means 12 is typically a device that allows for the programming of each station 10 individually such that each station 10 or 11 is controlled in accordance with a particular program. For example, this system 14 is particularly applicable to irrigation systems for irrigating an area of land (or a green house or lot feed yards) which may be used for watering vineyards or a crop plantation wherein each station 10 or 11 is distributed at various locations over the area of land. When a particular program is to be implemented, the controller means 12 will activate a pump or supply valve 40 to pump water through the tubes 2 so that the water flows through each station 10 or 11. Specifically, an encoded signal is sent along wires 4, 6 to stations 10A to turn on a switch which activates a solenoid to pump the water and a further encoded signal is sent to station 10A to turn off the switch which deactivates a solenoid to stop the pump. A similar operation applies to the system 16 of Figure 5. The controller encodes signals to be transmitted along the wires 4 and 6 that represent individual codes for each station 10 or 11 so that each station will perform a function when decoding a signal intended for that particular station. Say, for example, the station 10 which is closest to the controller means 12 may receive a signal which it decodes so as to activate a valve, under the actuation of a solenoid, which will then enable water to be distributed from that station to the immediate area of land

surrounding that station 10. This valve may be opened for a preset time in accordance with the program of the controller means 12 and can be closed to shut-off the water supply to that station upon receipt of another coded signal transmitted along wires 4 and 6 from the controller means 12. Similar signals may be sent to other stations from the controller simultaneously or at different times according to the program set so that other stations may be controlled in accordance with the codes or electrical signals sent along the wires 4 and 6. Depending on the distance of each segment of tube connecting the stations 10, 11 to the controller means 12 the electrical signals transmitted may need to be regenerated and this can be done in the usual fashion with known repeater systems and located at various points along the particular segment of tube or even located at a station 10 itself. The power supply may additionally be located at each station 10 to provide additional power to the stations which may ideally be in the form of batteries supplied or recharged through solar panels.

Apart from controlling each station to activate a valve for opening and closing, the electrical signals transmitted from the controller means 12 may be used to activate other electrical devices such as a pump switch or lights at each station or each station may include sensors which can transmit information back to the controller providing details about that area's environment. Any one of these devices may be additional to the solenoid control at each station 10.

Optical fibre cables may alternatively be used for the transmission medium 36 for transmitting optical signals between each of the stations 10 and controller means 12, as is shown in Figure 5. With reference to Figures 1 and 2, the optical fibre strand, which is enclosed with or without cladding and sheaths, may be coextruded as a single length of optical fibre with the tube 2 such that it is configured for transmission of optical signals in both directions, that is, upstream and downstream between two connections. Alternatively, a pair of optical fibres may be extruded with the tube 2 in any particular orientation around the periphery or outer surface of the tube 2 so that one optical fibre is configured for transmission in one direction and the other optical fibre is configured for transmission in the opposite direction to that of the first optical fibre. In similar fashion to the arrangement shown in Figure 4, the controller means 12 may communicate with the system 16 via the telecommunication

link 36 and with the processor means 32 via telecommunications link 34. Alternatively the controller means 12 may be linked to the system 10 via electrical signals transmitted over wires 4, 6 in which case an electrical to optical converter and optical to electrical converter unit20 may be used. An optical fibre cable or pair may be used to link the remotely located controller means 12 to the system 10 in which case the controller means 12 may have a unit 20 connected thereto for conversion of signals.

Thus, in Figure 5 electrical signals that are emitted from controller means 12 will be converted into optical signals by an electrical to optical converter (such as 19), which may ideally be in the form of a laser diode. The signals are then transmitted along optical fibre 22 in the case of a unidirectional fibre, or along optical fibre 23 in the case of a bidirectional fibre, along the length of the tube 2 to reach an optical to electrical converter (such as 18) such as a photodiode or photodetector, at one of the stations 10 where the signals are converted into electrical signals so as to control, in accordance with the program set by the controller, the station 10. Signals may be transmitted from the station 10 back to the controller means 12 by the reverse process. That is, by the conversion of electrical signals into optical signals and then transmitted along optical fibre 21 whereupon they are reconverted into electrical signals at the controller means 12. Alternatively, one optical fibre cable 23 may be used between the stations 10 and the controller means 12 wherein optical signals are transmitted in both directions and converted into electrical signals by a unit 20 which caters for electrical to optical signal conversion and optical to electrical signal conversion as previously mentioned. The use of optical fibre cables is particularly advantageous in situations where the stations are located at large distances away from each other and from the controller means 12. As such, the optical signals may need to be repeated in various locations along the length of the optical fibre cables or the tube 2 in which standard repeater systems may be used. In similar fashion, as with the pair of wires when the optical fibre cable is close to any one of the converters 18, 19 or 20 the cable can easily be stripped away from the tube 2 to enable easy access into the converters 18, 19 or 20 or alternatively a clip may be used as hereinbefore described. The use of optical fibre cables is particularly desirable where processing means, such

as computers, are used as the controller to control the system

The present invention substantially overcomes the difficulties presented by known techniques for controlling stations remotely located from a controller wherein a pair of electrical wires need to be connected from the controller means to each individual station 10. The present invention uses a pair of wires or even a single optical fibre cable to transmit and receive signals between the stations 10 and the controller means 12 which enable remote control of each of the stations 10 in accordance with a typical program set by the controller means 12. The pipe or tubing together with the extruded wires or optical fibre cable may be laid on the ground or buried beneath the ground between stations 10. It is to be noted that there may be any configuration of connection of the stations 10 to each other and to the controller means12 and this can be done in a loop wise fashion or through a number of connections emanating from one particular station 10 as is shown in Figure 3.

It will also be appreciated that various modifications and alterations may be made to the preferred embodiments above, without departing from the scope and spirit of the present invention

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS

1 Conduit means for transporting a fluid, such as gas or liquid, to be dispensed at one or more stations connected by said conduit means.

said conduit means having a transmission medium formed integrally with or bonded to the conduit means wherein said transmission medium is configured for transmission of information between any one or more of the stations and controller means so as to control any one or more of the stations or to transmit to or receive data from any one or more of the stations

2 Conduit means according to claim 1 wherein the transmission medium is configured for bidirectional transmission of said information between any one of said stations and the controller means

3 Conduit means according to claim 1 or claim 2 wherein the transmission medium is a pair of cables or wires formed integrally with or bonded to the conduit means such that transmission of said information, by means of electrical signals takes place bidirectionally, between any one or more of the stations and the controller means

4 Conduit means according to claim 3 wherein said pair of cables or wires is arranged in a casing which casing is formed integrally with or bonded to the conduit means.

5. Conduit means according to claim 3 or claim 4 wherein said pair of cables or wires is detachable from said conduit means adjacent a station to enable connection of each cable or wire to a respective terminal at said station

6. Conduit means according to claim 4 wherein said casing is detachable from said conduit means adjacent a station to enable connection of each cable or wire in said casing to a respective terminal at said station.

7. Conduit means according to any one of claims 3 to 6 wherein the transmission medium includes a further pair of cables or wires acting as a spare pair.

8. Conduit means according to claim 1 or claim 2 wherein the transmission medium is an optical fibre cable formed integrally with or bonded to the conduit means such that transmission of said information is by means of optical signals, and

said optical fibre cable is configured for duplex transmission of the optical signals

9. Conduit means according to claim 1 or claim 2 wherein the transmission medium is a pair of optical fibre cables, one of said pair of optical fibre cables configured to transmit information from said controller means to said one or more stations and the other cable of said pair configured to transmit information from said one or more stations to said controller means, said information being transmitted as optical signals

10. Conduit means according to claim 8 or claim 9 wherein at said one or more stations there are conversion means for converting said optical signals into electrical signals and for converting electrical signals into optical signals

11. An irrigation system comprising:

a plurality of stations distributed at various locations,

conduit means connecting each one of said plurality of stations for transporting fluid, such as water, to be dispensed at one or more of said stations;

a transmission medium formed integrally with or bonded to said conduit means;

said transmission medium being configured to transmit information between one or more of said plurality of stations and a controller means such that any one or more of said stations performs one or more functions in accordance with information transmitted by said controller means.

12. A system for controlling a plurality of stations, said system comprising:

said plurality of stations;

conduit means connecting each one of said plurality of stations for transporting fluid to be dispensed at one or more of said stations;

a transmission medium integrally formed with or bonded to said conduit means;

wherein said transmission medium is configured to transmit information between one or more of said plurality of stations and a controller means such that any one or more of the stations performs one or more functions in accordance with information transmitted by the controller means.

13. A system according to claim 11 or claim 12 wherein said transmission medium

is configured for bidirectional transmission of said information between any one of said stations and the controller means.

14. A system according to any one of claims 11 to 13 wherein said transmission medium is a pair of cables or wires formed integrally with or bonded to the conduit means such that transmission of said information, by means of electrical signals, takes place bidirectionally between any one or more of the stations and the controller means.

15. A system according to claim 14 wherein said pair of cables or wires is arranged in a casing, which casing is formed integrally with or bonded to said conduit means

16. A system according to claim 14 or claim 15 wherein said pair of cables or wires is detachable from said conduit means adjacent a station to enable connection of each cable or wire to a respective terminal at said station.

17. A system according to claim 15 wherein said casing is detachable from said conduit means adjacent a station to enable connection of the cable or wire in said casing to a respective terminal at said station.

18. A system according to any one of claims 14 to 17 further including another pair of cables or wires acting as a spare pair of cables or wires.

19. A system according to claim 11 or claim 12 wherein the transmission medium is an optical fibre cable formed integrally with or bonded to the conduit means such that transmission of said information is by means of optical signals and said optical fibre cable is configured for duplex transmission of the optical signals.

20. A system according to claim 11 or claim 12 wherein the transmission medium is a pair of optical fibre cables, one of said pair of optical fibre cables configured to transmit information from said controller means to said one or more stations and the other cable of said pair configured to transmit information from said one or more stations to said controller means, said information being transmitted as optical signals.

21. A system according to claim 19 or claim 20 wherein at said one or more stations there are conversion means for converting said optical signals into electrical signals and for converting electrical signals into optical signals.

22. A system according to claim 11 or claim 12 wherein said controller means transmits information to enable one or more of said stations to control the operation of

a valve at said one or more stations, such as closing or opening the valve.

23. A system according to claim 11 or claim 12 wherein said controller means transmits information to said one or more stations so as to operate a device, such as a motor, pump or switch at said station.

24. A system according to claim 11 or claim 12 wherein information is transmitted to said controller means by any one of said stations, said information representative of an acknowledgement signal or a parameter associated with said station or associated with a device at said station.

25. A system for transmitting information between one or more stations and a controller means, said system comprising:

said one or more stations;

conduit means connecting said one or more stations wherein fluid, such as gas or liquid, is transported in said conduit means to be dispensed at said one or more stations; and

a transmission medium for transmitting said information,

wherein the transmission medium is formed integrally with or bonded to the conduit means and said information is transmitted between said one or more stations and said controller means to control any one or more of the stations, or receive data from any one or more of the stations

26. A system according to any one of claims 11 to 25 wherein the controller means is remotely located from and in communication with said one or more stations by using a wireless telecommunications link over which said information is transmitted and received.

27. A system according to any one of claims 11 to 26 wherein said information is transmitted to or received from a processor means.

28. A system according to claim 27 wherein the processor means is linked to said controller means through a wireline link, such as a cable or optical fibre, or through a wireless telecommunications link.

29. A system according to any one of claims 11 to 28 wherein information is transmitted to said one or more stations so as to enable said station to perform a predefined function, such as controlling a valve, operating a device or a switch at said

station.

30. A system according to any one of claims 11 to 29, wherein data is transmitted from any one or more of the stations to said controller means or said processor means representative of certain parameters at said stations or acknowledgement signals from said stations.

31. A system according to any one of claims 11 to 30 wherein said transmission means delivers power to any one or more of said stations.

32. A system substantially as hereinbefore described with reference to the accompanying drawings.

33. Conduit means substantially as hereinbefore described with reference to the accompanying drawings.

DATED: 2nd October 1998

CARTER SMITH & BEADLE

Patent Attorneys for the Applicant:

THE TECHNOLOGY GROUP PTY LIMITED

station.

30. A system according to any one of claims 11 to 29, wherein data is transmitted from any one or more of the stations to said controller means or said processor means representative of certain parameters at said stations or acknowledgement signals from said stations.

31 A system according to any one of claims 11 to 30 wherein said transmission means delivers power to any one or more of said stations

32. A system substantially as hereinbefore described with reference to the accompanying drawings

33 Conduit means substantially as hereinbefore described with reference to the accompanying drawings

DATED 27 October 1998

CARTER SMITH & BEADLE

Patent Attorneys for the Applicant

THE TECHNOLOGY GROUP PTY LIMITED

Abstract

Conduit means (2) for transporting a fluid, such as gas or liquid, to be dispensed at one or more stations (10, 11) connected by the conduit means (2) wherein the conduit means (2) has a transmission medium (4, 6) formed integrally with or is bonded thereto. The transmission medium (4, 6) is configured to transmit information between the stations (10, 11) and controller means (12). An irrigation system and a system for controlling a number of stations is also disclosed

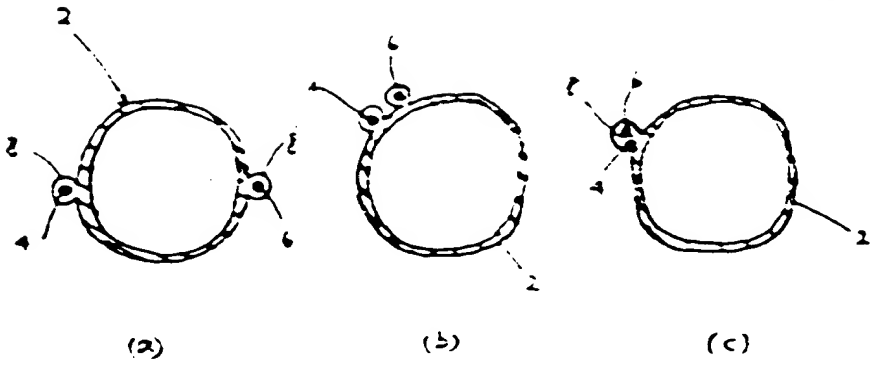

FIG. 1

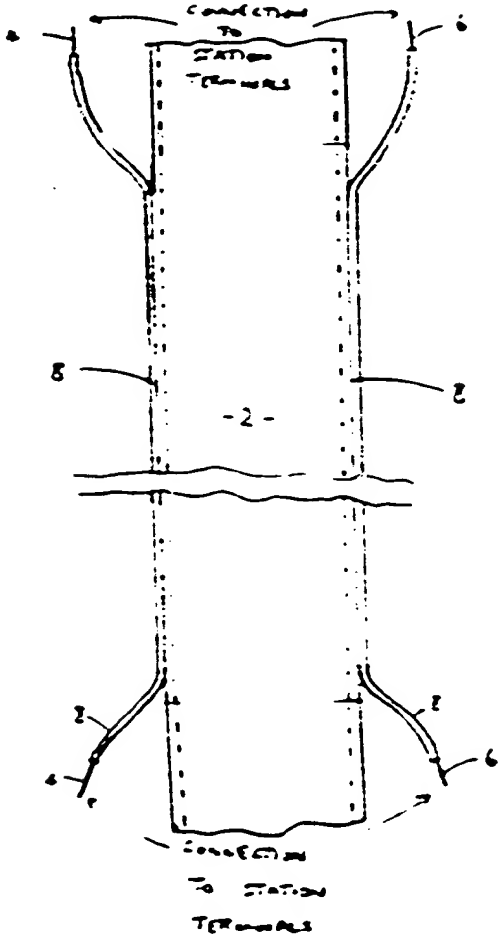

FIG 3

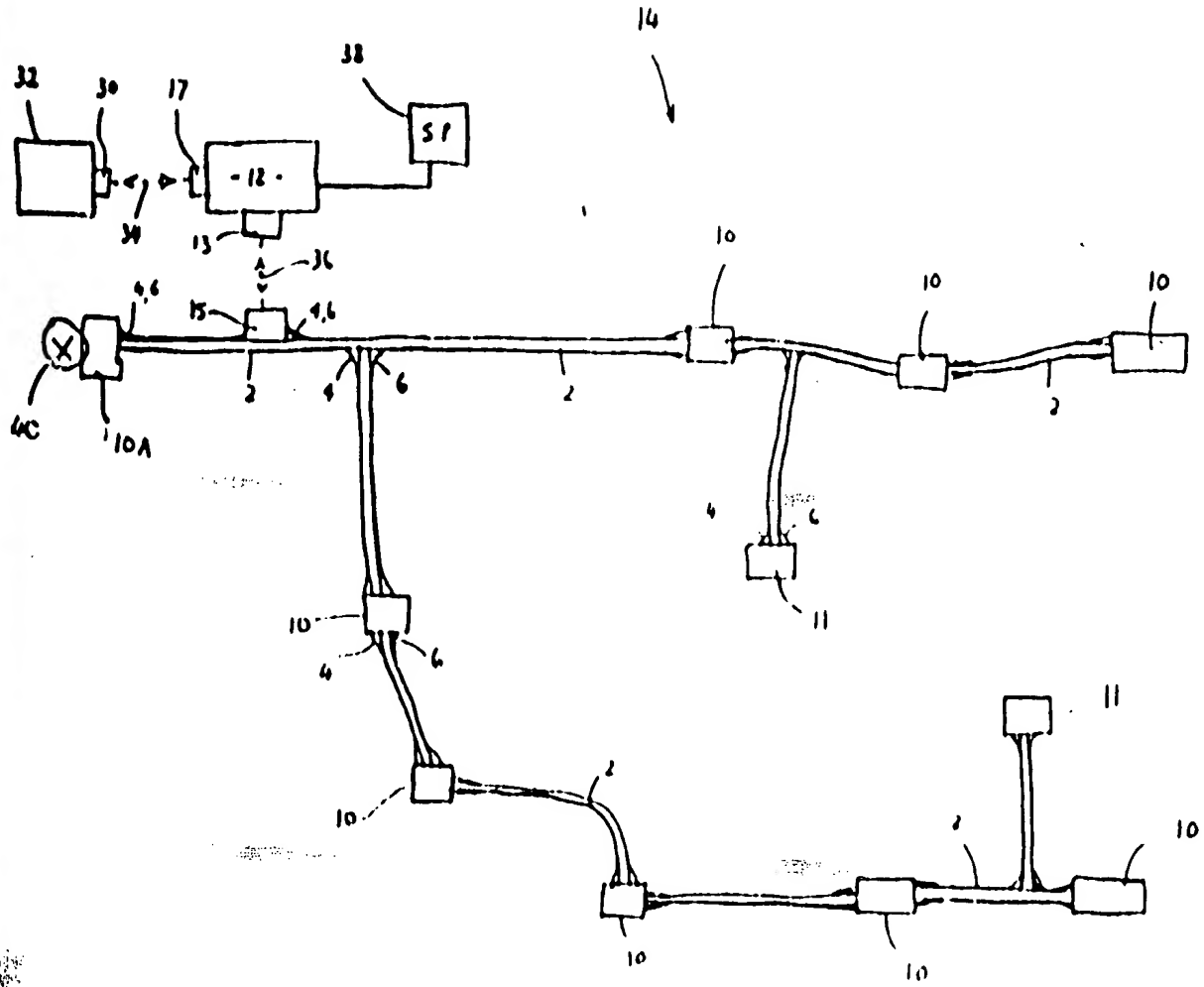
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FIG. 4

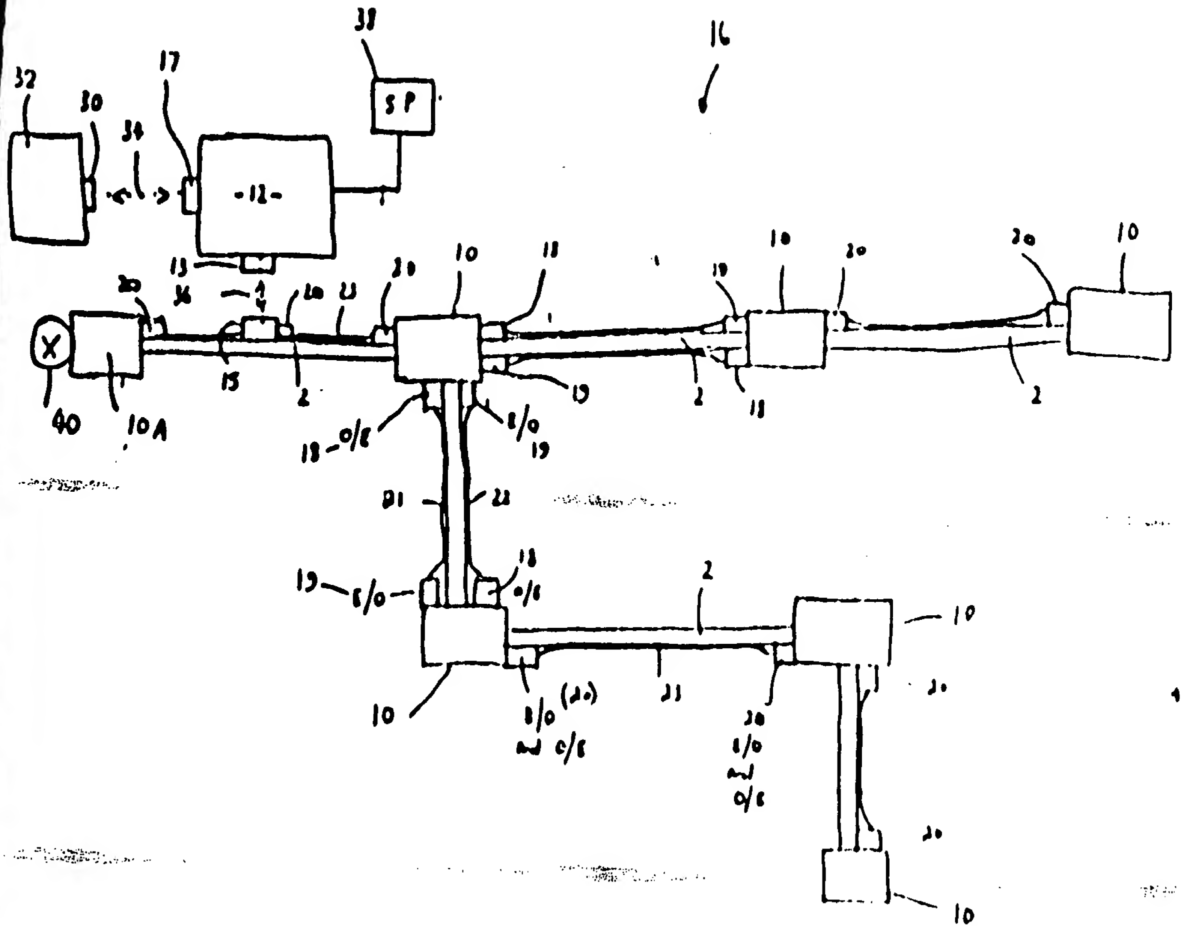

FIG 5

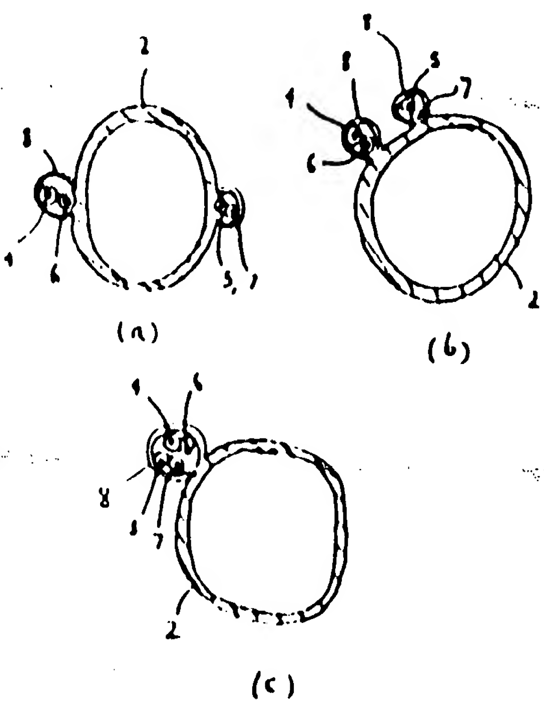

FIG. 2

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